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Type I Progress Report for the Period 14 June to 14 August 1973 for ERTS-1 Data User Investigation of the Use of ERTS Imagery in Reservoir Management and Operation - Proposal Number MMC 89

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The seventh 2-month period of our participation in the ERTS-1 program has been featured by:

- a. Continued collection and entry of all DCS and ground truth data into our computer, and continued analysis of this data to provide system reliability and data availability statistics.
- b. Preliminary work in the preparation of the Proceedings of the ERTS-1 Data Collection Workshop held at Wallops Station, Virginia on 30-31 May 1973, in cooperation with personnel from NASA GSFC, Maryland and Wallops Station, Virginia.
- c. The mailing of our questionnaire to determine the automated data collection needs of all offices of the Corps of Engineers in this country (see July 1973, Type II Report for a copy of the questionnaire).
- d. Continued development of techniques for analyzing ERTS imagery products to aid Corps watershed management functions, including snow and ice mapping, determining of water storage characteristics of river flood plains and wetlands and investigating turbidity and sedimentation in certain water bodies.
- e. Continued progress in the development of a man/computer interactive system for ERTS image processing including a new study of the applicability of automatic data processing techniques for surface water inventorying and classification.
- f. Collection of pertinent data relating to the late June,

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E73-11144) ERTS-1 DATA USER
INVESTIGATION OF THE USE OF ERTS IMAGERY
IN RESERVOIR MANAGEMENT AND OPERATION
Progress Report, 14 (Corps of Engineers,
Waltham, Mass.) 5 p HC \$3.00 CSCI 08H

early July 1973 New England flood (see July 1973 Type II Report for further details) to support a study of the potential usefulness of satellite imagery and data collection for NED water related purposes both during and after a significant flood event.

A listing of the locations of our operating DCP's and proposed sites is inclosed. Note changes from the list submitted with our last report. Data relay from NASA via our real time teletype link continues to be timely, with a lag of approximately 45 minutes between ERTS-1 passover and arrival of the data at the New England Division. We wish to express our approval of the new format for DCS punchcard and computer printout data. We have also been especially pleased with the efficiency and attentiveness to the DCS program that has been evident on the part of NASA during the recent reporting period. Our association with Mr. Gale, of NASA GSFC, has shown him to be outstandingly concerned with both the overall needs of the DCS program and individual investigators involved in it.

The ERTS-1 DCP hardware continues to perform well. The few remaining equipment problems concern the water quality monitoring sites, and are sensor, rather than DCP-related. Seasonal variations in climate and associated meteorological extremes from winter through summer have had no noticeable effects on the operating capabilities of our DCP's. The "Gel-Cell" batteries that power the DCP installations continue to exceed all expectations of useful life. Several sets of batteries were in continuous operation for as much as 12 months before failure, compared to 4 to 6 months' life expectancy.

Precipitation and coastal station sensor problems have been overcome and data from these stations are now being analyzed together with that from the river stage sites. The percentage of the number of good reports to total reports received for each of the operating DCP's continues to be 95 percent or higher in nearly all cases. The overall figure for our DCS system is 97.7 percent, based on data for the period from 1 January 1973 through 9 September 1973. (For a detailed discussion of how these statistics are computed see pages 5-6 of our July 1973 Type II Report).

We are continuing to actively pursue our interest in having a direct DCS downlink installed at our Waltham Headquarters. Considerable time has been spent in the past several months exploring the hardware

requirements of such a setup. We have asked NASA, Wallops Station personnel to assist in our evaluation of equipment and also to cost out a complete downlink.

Our imagery studies during the reporting period have been mainly a continuation of work reported in the July 1973 Type II Report. These include studies for developing techniques for using ERTS imagery in snow and ice mapping, determining of water storage characteristics of river flood plains and wetlands and investigating turbidity and sedimentation in certain water bodies.

In the development of a man/computer interactive system for ERTS image processing, we currently can print sections of images from MSS tapes onto paper or onto an IBM 2250 Cathode Ray Tube (CRT). Close-up and wide angle shots may be obtained and worked with on the CRT screen. Work is now proceeding with the next step, involving study toward an efficient means of information reduction, storage and retrieval. Ideas concerning reducibility and reconstructability of high dimensional data are being pursued. A picture associated language will be developed to serve as the core of the data base which will be organized into a hierarchical tree-like structure for efficient storage and retrieval. In this structure, each type of hydrologic event is assigned a set of names. Each name in turn has a list of characteristics, each one of which has associated an estimated probability to reflect its uncertainty. In our interactive environment these characteristics include both the information obtained from the actual image, and the ground truth supplied by the operator. Through this system a dynamic information file will be developed for the images which will be accessible through the hydrologic events.

New work is proceeding to determine the applicability of automatic data processing of ERTS imagery for surface water inventorying and classification.

During the reporting period the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) continued with the construction of an ERTS imagery mosaic of all New England at a scale of 1:500,000.

We continue to be in contact with other ERTS investigators, and

especially personnel from the U.S. Department of the Interior, National Oceanic and Atmospheric Administration and NASA. A major one-day coordination meeting involving the New England Division, Corps of Engineers, U.S. Army Cold Regions Research and Engineering Laboratory, the University of Connecticut and the U.S. Geological Survey, Hartford, Connecticut took place at the New England Division Headquarters on 1 August 1973. The meeting featured progress reports and discussions of future plans for all aspects of this ERTS-1 investigation. Mr. Fred Ruggles of the USGS, Hartford, reported on his studies of flood analysis, using ERTS-1 imagery and coordinated certain aspects of his planned future work of this type with those groups present at the meeting.

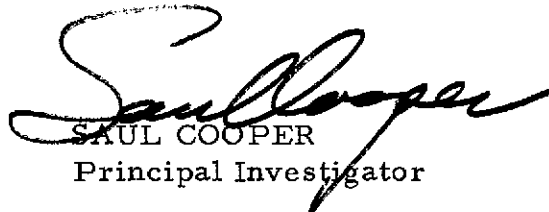
The following data requests were submitted to NASA since our last Type I report:

5/11: magnetic tapes for five ERTS-1 images

6/29: magnetic tapes for two ERTS-1 images

We also requested extra fast service as well as additional imagery products to cover the flood in New England imaged by ERTS-1 on 5, 6 and 7 July. We were quite pleased by the cooperativeness of NASA in this and the speed with which our order was filled. No changes were made in our ERTS standing order forms since our last Type I Report.

1 Incl
As stated


SAUL COOPER
Principal Investigator

ERTS-1 - DCP INFORMATION SHEET
ARMY CORPS OF ENGINEERS, NEW ENGLAND DIVISION

14 AUG, 1973

ID NO.	DCP NO.	TYPE*	STATION NAME	LAT	LONG	IN-STALLED
1	6233	S	ST. JOHN RIVER AT FORT KENT, MAINE	47 15	68 35	091972
8	6220	S	ST. JOHN RIVER AT NINEMILE BR., MAINE	46 42	69 43	073073
2	6355	S	PENOBSCOT RIVER AT WEST ENFIELD, MAINE	45 14	68 39	092072
3	6246	S	CARABASSETT RIVER AT NORTH ANSON, MAINE	44 52	69 57	100472
5	6171	S	SACO RIVER AT CORNISH, MAINE	43 48	70 47	112872
6	6273	S	PEMIGEWASSET RIVER AT PLYMOUTH, N.H.	43 45	71 41	112272
7	6304	S	MERRIMACK RIVER AT GOFFS FALLS, N.H.	42 57	71 28	032773
9	6356	S	CHARLES R. AT CHARLES R. VILLAGE, MASS.	42 15	71 15	071772
10	6207	S	TOWN BROOK AT QUINCY, MASS.	42 15	71 00	090872
41	6142	S	NORTH NASHUA RIVER AT FITCHBURG, MASS.	42 34	71 47	110672
11	6010	S	PAWTUXET RIVER AT CRANSTON, R.I.	41 45	71 27	090672
13		S	BRANCH RIVER AT FORESTDALE, R.I.	42 00	71 34	
12	6127	S	CONNECTICUT RIVER AT HARTFORD, CONN.	41 46	72 40	083072
20	6042	P	STINSON MOUNTAIN, N.H.	43 50	71 47	032273
21	6345	P	SOUTH MOUNTAIN, N.H.	42 59	71 35	120672
22	6206	P	FRANKLIN FALLS DAM, N.H.	43 28	71 40	051773
23		P	BLACKWATER DAM, N.H.	43 19	71 44	
24	6012	P	MACDOWELL DAM, N.H.	42 54	71 59	042473
26		P	WACHUSETT MOUNTAIN, MASS.	42 29	71 53	
25		P	MANSFIELD HOLLOW DAM, CONNECTICUT	41 46	72 11	
30	6101	C	STAMFORD BARRIER, STAMFORD, CONNECTICUT	41 02	73 32	011073
40	6254	Q	ASHUELOT RIVER AT WINCHESTER, N.H.	42 47	72 23	121272
42	6272	Q	WESTFIELD R. AT WEST SPRINGFIELD, MASS.	42 06	72 38	092872
43	6242	Q	CHICOPEE RIVER AT CHICOPEE, MASS.	42 09	72 35	121472
50	6147	T	NED HEADQUARTERS, WALTHAM, MASS.	42 24	71 13	071772
51	6325	T	COLD REGIONS LAB AT HANOVER, N.H.	VARIABLE		042373
52	6216	T	COLD REGIONS LAB AT HANOVER, N.H.	VARIABLE		120572
54	6063	T	U.S. GEOLOGICAL SURVEY, BOSTON, MASS.	VARIABLE		032073

* S-RIVER STAGE

P-PRECIPITATION

C-COASTAL(WIND DIRECTION, VELOCITY AND TIDE)

Q-WATER QUALITY(TEMPERATURE, CONDUCTIVITY, PH AND DISSOLVED OXYGEN)

T-TEST SET(SENSORS VARIABLE)